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ABSTRACT

This issue uses tomato processing to illustrate the new directions and opportunities available in the food market. Comparative advantage and economies of scale are discussed in relation to markets. Forecasting success in the market is attributed to studying consumer consumption trends by type and monitoring standards of living in 32 newly industrialized countries throughout the world. The booklet concludes with a student quiz. (EH)

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Food Processing and Marketing New Directions... New Opportunities

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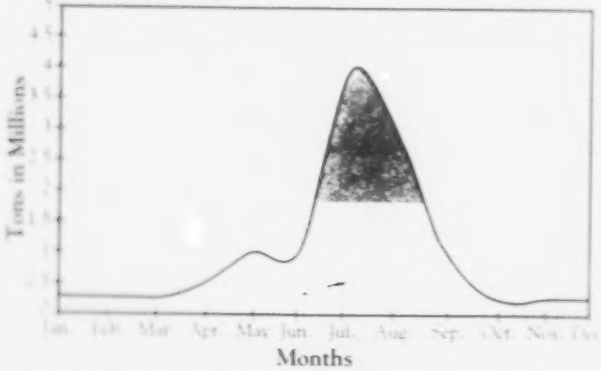
FOOD PROCESSING AND MARKETING
NEW DIRECTIONS... NEW OPPORTUNITIES

In the early 1960s, the *comparative advantage* of growing tomatoes in the eastern United States and the Midwest was being lost to California because of the longer growing season. This was a great concern to the tomato industry in the Midwest; and in an effort to save the industry in Indiana, a Purdue University economist working with a food scientist at Purdue University decided to put business and science together to identify and help solve this problem. Their joint efforts have revolutionized the tomato industry.

Dr. Glenn Sullivan, an agricultural economist in the Food Institute at Purdue University, identified the problem illustrated in Figure 1.

Figure 1. Tons of tomatoes grown, ready for processing during the 1993-94 growing season.



Because tomatoes are highly perishable, they must be processed shortly after harvest. During the 1950s and early 1960s, tomato canneries in the Midwest had to be large enough to handle the volume harvested in July and August. During the rest of the year, much of the labor force was laid off except for

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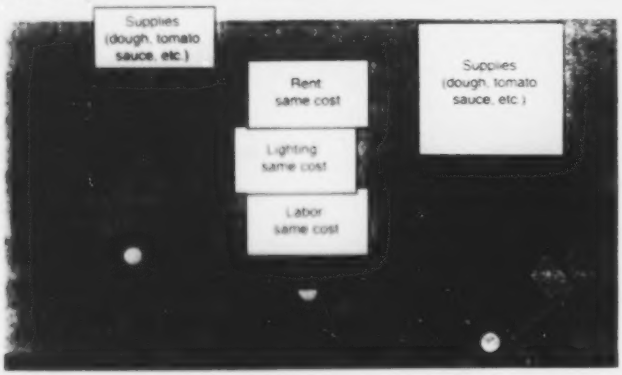
a few individuals who kept the facilities open. This is an excellent example of how *diseconomies of scale* worked to the **comparative disadvantage** in the industry.

There was a lot of capital invested in the equipment and facilities; and while these facilities were processing at high capacity during the harvest season, they were highly underutilized during the off-season. Except for July and August, the facilities were used only to reprocess canned tomatoes or juice as the changes in demand were determined.

EXAMPLE OF ECONOMIES OF SCALE:
When a pizza store doubles its output, the owner still pays the same amount in fixed costs, such as rent and lighting. If the employees were under worked, no extra labor costs would be necessary. If the oven was not being used to capacity, there would be no extra costs for equipment. The only extra cost is for the supplies used to make and package the pizzas, which represent a fairly small fraction of the total costs.
– This is illustrated in Figure 2.

Figure 2. Economics of scale: Why it may cost only a little more to produce twice as much.



What needed to be done was to redistribute the volume (labeled A) in Figure 1 of processing to other months of the year, thus capturing the *economies of scale*. Dr. Sullivan teamed up with Dr. Philip Nelson, who was

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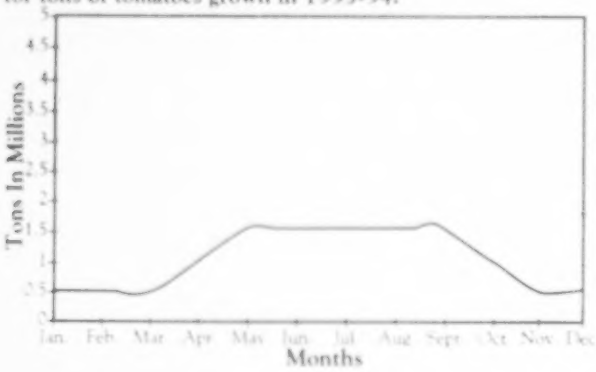
interested in applying science and technology to this situation in hopes of meeting the challenges of this dynamic and changing environment, the Indiana tomato industry. If the tomatoes in Figure 1 could be processed at a rate which would change the graph to look like Figure 3, facilities in Indiana might be saved from going out of business.

Figure 3. Final processing schedule possible with aseptic processing for tons of tomatoes grown in 1993-94.



Using this analysis, Drs. Sullivan and Nelson, working with a team of food scientists and food engineers at Purdue University, developed "aseptic processing," which was patented in 1972. The inventors are listed as Philip E. Nelson and Glenn H. Sullivan, Purdue University, West Lafayette, Indiana.

Briefly, aseptic processing/storage involves heating the product to a high temperature for a short period of time, then cooling the product quickly and storing this sterile product in sterile containers. The product can be held in large aseptic silos (Figure 4) without refrigeration until needed for processing specific tomato-based products.

It is no longer necessary to know in August how much sauce, salsa, or catsup will be needed during the winter months. Production schedules can be determined closer to the time that further processing will occur, thus the projections can be much more accurate.

Q. How many economists does it take to change a light bulb?
A. How many did it take this time last year?

—The Jokesmith

Forecasting the demand of a product is an important factor in any industry whether it is automobiles, computers, or salsa. The successful economist whose job it is to estimate steel, micro chips, or kinds of tomato-based products, i.e., catsup, juice, stewed tomatoes, spaghetti sauce, or salsa must take many factors into consideration. These forecasts are often made like the joke, how much did we need last year—and often lead to large errors in production and/or inventory.

Before aseptic processing, all tomato products were processed during the harvest season, whereas these products can be processed closer to the time needed for consumption, thereby making projections for specific tomato-based products much more accurate. By using aseptic processing, the producer can partially process tomatoes (chopped, sterilized, and/or concentrated) to postpone the costly and time-consuming step of final inventory until after the harvest season when the market dictates precise products, volumes, and sizes. It is no longer necessary to guess which products will be needed at any given point in the year.

For greater efficiency in storage and transportation, tomatoes can be concentrated to paste (removing water), which reduces their volume to 31 to 33 percent solids. This process allows more tomato product to be shipped at a lower cost. Even though tomatoes are predominantly grown in California, Indiana benefited from a further development: the design of aseptic tank rail cars. Tomato paste can be stored in silos in California; and when a plant in Indiana needs the tomato product for catsup, the plant orders one or two tank cars of tomato paste and has the paste shipped to Franklin, Indiana.

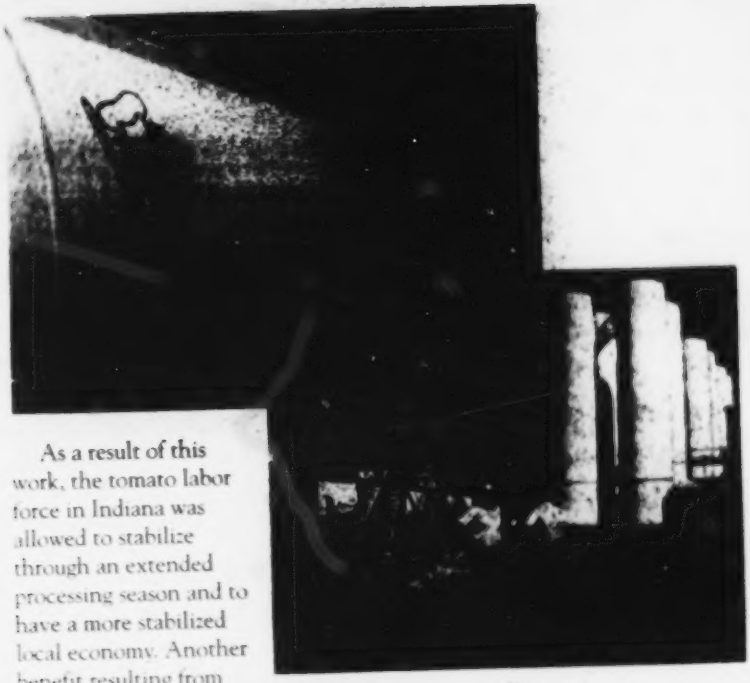


Figure 4.

As a result of this work, the tomato labor force in Indiana was allowed to stabilize through an extended processing season and to have a more stabilized local economy. Another benefit resulting from bulk storage allowed for tomatoes which were not as ripe or overly ripe to be blended during final processing to produce an acceptable quality product, thereby creating even greater value and economic returns.

How Many Tomatoes to Grow — A Forecasting Nightmare

Not only have the tomato processors benefited from these studies, the tomato growers also had much to gain. It is their challenge to decide how many tomato seedlings to plant for the production of tons of tomatoes needed for processing in a given year. This task is made more efficient when accurate demand forecasts are available. As you can see from Figure 1, in 1993-94 more than 12 million tons of tomatoes were processed. Other forecasters estimated that producers should cut back because demand would call for less than ten

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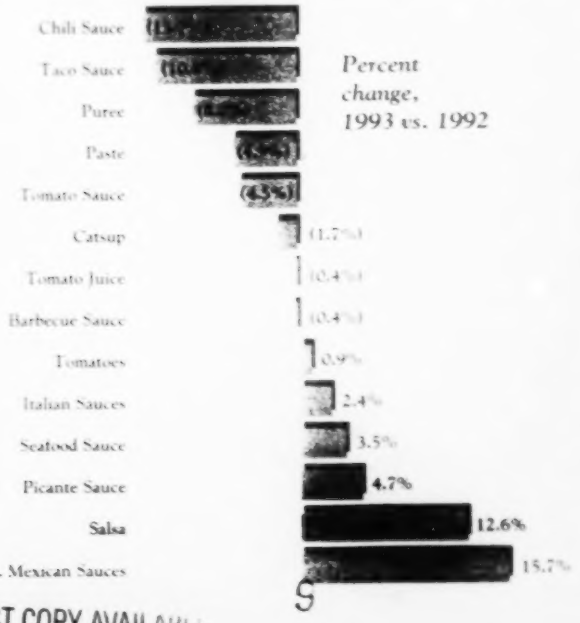
million tons. Sullivan predicted that not only would there be a demand for 12 million tons, but the price would stabilize at 39 to 40 cents per pound for tomato paste on world markets, and his forecasts have held true. Many economists who make similar predictions may base their judgment on past trends, and what prices and demands were required in previous years at the same time, much like the economists in the light bulb joke.

Dr. Sullivan attributes his forecasting success over the past several years to two factors.

Studying consumer consumption trends by type. It is probably not surprising that salsas and prepared ethnic sauces have caused the demand for tomatoes to soar. Other forecasters were only looking at past use of products like whole tomatoes, catsup, and juice. By looking at the growth products individually and by region, Sullivan is able to more accurately predict the growth trends and future demand for these popular products. See Figure 5.

Figure 5. Tomato products: supermarket sales performance, 1993.



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Monitoring standards of living in 32 newly industrialized countries throughout the world. Why is this an important factor when calculating a forecast for the coming growing and processing season? Sullivan and his group discovered that without exception when the Gross Domestic Product (GDP) reaches $3000 per capita, the people change their diets. They move away from subsistence diets such as rice and beans to value-added diets that include pasta. This action immediately calls for a tomato-based product to put on the pasta. Even though people are not able to buy a car or television set, they can and will upgrade their diets and buy tomato-based products for their pasta. This phenomenon happens very quickly, once the diet upgrade is made. It can be referred to as "new demand."

Each time people in a developing country change their diet, the base of consumer demand for tomato products broadens. This is an important source of information for Sullivan to use in developing projections for his "demand-based" forecasts. This information is made available to producers/processors; and since over half of the processing tomatoes are grown in the United States, this becomes a very important statistic to follow in projecting demand for world markets.

In industrialized countries, an evolution took place as better tomato hybrids and mechanization for growing and harvesting tomatoes were developed. The customers of newly developing countries instantly benefit from technology which perhaps took 50-plus years to develop, and they are able to have high-tech processed products immediately. This knowledge transfer might be referred to as a "leap-frog" effect of technology transfer. Each time this phenomenon happens, the tomato industry changes, causing it to be in constant flux.

"It is important to understand," Sullivan says, "that current industry prices are not the result of declining long-term demand or

domestic oversupply, but rather a reflection of inadequate market planning strategies in a dynamic and rapidly changing global marketplace."

As the world changes, it becomes increasingly important for industries to keep looking for ways to meet the needs and demands of consumers in the United States as well as in overseas markets. Sullivan estimates that over two-thirds of new demand during the next decade will take place outside of the United States.

SUMMARY

Eighty-seven percent of the United States tomatoes for processing in the United States and 49 percent of the processing tomatoes for world markets are grown in California. You would think that the research for the most efficient processing, storage, and marketing would be developed near the source. Technical knowledge is not place specific, and it is easily transferrable.

At Purdue University, a process called aseptic processing and storage was developed and patented by Dr. Philip Nelson and Dr. Glenn Sullivan. It has revolutionized and continues to revolutionize the processing industry. This process has allowed the industry to greatly increase its *economies of scale* and become the most competitive in the world.

Through a joint effort of economic analysis and technology, the dying tomato processing industry in the Midwest, which had lost a major *comparative advantage* to California, was revitalized. Tomato processors were able to redistribute their processing schedules to allow for processing the product throughout the year rather than just during harvest.

There are widespread career opportunities for professionals in the food industry to research, analyze, manage, and communicate technological advances that are constantly being discovered and developed with and for industry to keep the food supply the most efficient and inexpensive in the world.

Glenn H. Sullivan is a professor of Marketing and Economics at Purdue University. As professor of the Food Science Institute since 1979, Dr. Sullivan has served as Deputy Commissioner of Agriculture for the State of Indiana and has garnered several awards including the Eugene L. Grant Award for "pioneering economic contributions to the food industry"—in aseptic food processing.

Professor Sullivan's most current research focuses on integrated production management, marketing, and international trade in fruit and vegetable crops. His work is recognized worldwide. As a consultant to the food industry, Sullivan has served as economic and strategic market planning consultant to over twenty-one firms industry wide.

The technical and professional assistance given by Professor Sullivan is greatly appreciated.

QUIZ

1. In Figure 1, what does the section of shaded area labeled A represent?
   A. The tons of tomatoes grown only in Indiana in 1993-94.
   B. The tons of tomatoes grown in the United States for the 1993-94 growing season.
   C. The tons of tomatoes that can be processed at a later time into final product because of aseptic processing/storage.
   D. The tons of tomatoes estimated lost to spoilage in the 1993-94 processing season.

2. Hawthorne High School is planning their prom. Which of the following best demonstrates the concept of "economies of scale?"
   A. XYZ band is hired for the prom. If 150 tickets are sold, the students will be able to pay the band's fee. Any tickets sold over 150 is profit for the class.
   B. The budget for the band is exceeded by $300. If students ask for parents to make refreshments instead of paying a caterer, the prom committee will meet its economies of scale.
   C. The band is the most expensive budget item. So the price charged by the band determines how many tickets must be sold to break even.
   D. By selling 500 tickets, the prom committee will break even. The committee sells 625 tickets. Since parent's are donating the refreshments, the extra costs are minimal for the extra 125 tickets sold, the profits are for the extra 125 tickets.

3. Which of the following exemplifies the success Dr. Sullivan has had in forecasting the tons of tomatoes needed to meet processed tomato markets in a subsequent year?
   A. When a developing country increases its standard of living, the people upgrade their diets to include tomato products before buying modern conveniences for homes.
   B. If the price is high, growers will plant more tomatoes to generate more profits for themselves.
   C. The forecast is based on an average demand of the previous year plus 2.3 percent increase to account for developing countries as they begin to eat pasta instead of beans.
   D. None of the above are true.
   E. All of the above are true.

4. In the text, the "leap frog" effect refers to:

   A. The technology for processing tomatoes was developed at Purdue University rather than a California research university where most of the processing tomatoes for domestic and world markets are grown.

   B. Being able to purchase a product immediately that has taken years to develop elsewhere.

   C. It took several years to develop a new strain of tomato that is resistant to the damage of infestation of frogs.

   D. Only A and B are true.

   E. None of the above are true.

5. Dr. Sullivan estimates that during the next ten years, over two-thirds of the new demand for processing tomatoes will take place outside of the United States. (True or False)

6. Which of the following benefits did the tomato industry realize as result of the development of aseptic processing?

   A. Tomatoes could be finally processed in Indiana in off-season times.

   B. Tomatoes could be picked earlier allowing a second crop to be grown in the same season.

   C. The demand for specific tomato products could be determined later in the processing season.

   D. Indiana tomato packers can get fresh tomatoes from California anytime of the year.

   E. Only A and C are true.

7. Which of the following situations causes the tomato industry to be in constant change according to Dr. Sullivan?

   A. Tomatoes are so perishable that it is never known how many tomatoes will spoil before they are processed.

   B. World markets are demanding tomato products for their pasta when they upgrade their diets.

   C. Most economists do not have good forecasting models to know what the markets are likely to be.

   D. The price of tomato paste changes constantly depending on the tomatoes grown in a year in California.

   E. Only B and C are true.

8. When a tomato processing plant in Indiana orders tomato product in February to make catsup, why is aseptic paste shipped rather than aseptic chopped tomatoes?

A. Water is heavy and expensive to ship.
B. Chopped tomatoes cannot be reduced to catsup.
C. Paste has a longer shelf life than chopped tomatoes.
D. All of the above are true.
E. None of the above apply.

9. How was it possible to retain some of the tomato industry in Indiana when much of the tomato production was lost to California?

A. The research in new tomato products was developed at the University of California—Davis.
B. Aseptic processing allowed plants to process tomato products in Indiana throughout the year, using shipments of tomato paste from California.
C. Aseptic processing was developed and patented in Indiana.
D. Aseptic processing has nothing to do with Indiana's continuing ability to process tomatoes.

10. As seen in Figure 5 of the text, the growth of tomato products has been in tomato sauces. Why do you believe this is true?

A. Pasta has become a very important and popular food item all over the world.
B. Ethnic foods have become very popular in the United States.
C. Sauces are cheaper to produce.
D. Sauces are made from tomato paste.
E. All of the above are true.
F. A and B are both true.

ANSWERS: 1-C; 2-D; 3-A; 4-B; 5-T; 6-E; 7-B; 8-A; 9-B; 10-F

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Contact: Mary A. Welch

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